Materials Science & Engineering Graduate Seminar

Wednesday, October 30 2019, 4:10-5:00PM, WEB 1230

Dr. Oliver Johnson

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Google and Grain Boundary Networks (or Can you hear the structure of a Grain Boundary Network?)

Grain boundaries form complex three-dimensional networks whose aggregate structure has a dramatic influence on the properties of materials. The character of an individual grain boundary is typically characterized by its five macroscopic crystallographic degrees of freedom. The character of a grain boundary network (GBN) is much more complex, including the characters of constituent grain boundaries and their spatial arrangement. Typical approaches to quantifying GBN structure have relied upon reduced order schemes that describe the connectivity of "special" and "general" grain boundaries. This binary taxonomy ignores the broad and continuous spectrum of GB types and properties. In this talk, I will present a new technique, developed in our lab and based on spectral graph theory, to characterize the aggregate structure of GBNs, and which encodes the full continuous spectrum of GB types. I will discuss how this new tool can be used to design GBNs for tailored material properties, finding optimal microstructures for diffusion phenomena.

Dr. Johnson earned a PhD in Materials Science and Engineering from the Massachusetts Institute of Technology (MIT) and joined the faculty of the BYU Mechanical Engineering Department in 2015. His research incorporates theoretical, computational, and experimental approaches to design and synthesize advanced materials. Areas of particular interest include the design of defect networks in hard materials, experimental and theoretical methods for quantifying structure-property correlations, and synthesis of designed microstructures. He is the recipient of an NSF CAREER award, and the National Defense Science and Engineering Graduate Fellowship (NDSEG).